Saskatchewan
Research Council

ROTARY CUTTINGS:
RELIABLE SAMPLES OF SUBSURFACE TILL
TO MINIMAL DEPTH OF 500 FEET

by

W.C. Ross

SRC Technical Report No. 224

Publication R-842-3-B-86

July, 1986

90-03982/

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INTRODUCTION

Rotary cuttings, recovered from subsurface drilling, are satisfactory samples for carbonate analyses to a minimal depth of 500 feet. Sidewall cores and rotary cuttings were recovered from similar depth intervals of subsurface till units. Both types of samples were analyzed for carbonate content as total CO_2 evolved (mls/gm). A linear regression calculation for these analytical results revealed a coefficient of correlation to be 0.935, and thus indicating that the cores and cuttings are comparable samples for carbonate analyses.

The advantage of rotary cutting samples, in comparison to the sidewall cores are twofold:

(1) The cuttings are recovered from 10 foot intervals, and the analyses of these cuttings gives an average carbonate value for each sampled interval, whereas the cores are taken from exact depths, and sometimes erratic till inclusions (e.g. a silt lens) may be sampled, and the analytical results are not representative for the till unit.

(2) The cost of recovery of rotary cuttings is a small percentage of the additional time that is required in this sampling procedure, possibly 5%, whereas core sampling by the standard rotary core tube, or shelby tube may add an appreciable cost to the testhole; with coring at deep intervals near 500 feet depths, the increase in costs could approach 50%.

The rotary cuttings, being suitable for laboratory analyses to a minimal depth of 500 feet, have been raised to the rank of 'authentic samples', i.e. they are representative for subsurface till units.

PROCEDURE FOR RECOVERY OF ROTARY CUTTINGS

The accuracy of the results of any laboratory analysis depends on several factors, one being that the sample is representative of the sampled unit. In test–drilling this is achieved by an experienced (well–site) geologist.

The geologist works in close association with a competent driller so that the samples are not only authentic but also the recorded depth intervals are correct.

A definite drilling procedure enables the geologist to glean maximum information from each testhole.

This report does not cover the explicit drilling procedures, as used by, the Saskatchewan Research Council.

CARBONATE ANALYSES

Samples were analyzed by the Heinze Gasometer Method (Ross, 1986) and the volume parameters were used to express the total carbonates in each sample,

i.e. Volume of CO_2 Evolved (STP)[1] total carbonates in sample.

(units mls/gm of sample) (wt % equivalent)

Matched sample pairs were recovered from corresponding till intervals. A sample pair consists of:

(1) Sidewall core sample from a specific depth.

and (2) Rotary cuttings from a 10 foot interval which includes the depth from which the sidewall core was recovered.

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[1] STP – at standard temperature (0|C) and pressure (76 cm Hg).

CARBONATE PROFILE PLOTS

The analytical results for carbonate analyses are illustrated as depth–profile plots as shown by Figures 1 to 10. The carbonate parameter, total volume of CO_2 evolved per gram of sample, was plotted at corresponding sample depths; the sidewall core results are represented by the symbol 'o' and plotted at the exact designated sample depth, whereas the rotary cutting results which are represented by the symbol 'x' are plotted at the midpoint of the designated interval. Should the interval be less that 10 feet due to an abrupt lithologic change, then the results are plotted at the midpoint of the marked interval.

RESULTS

A detailed examination of each of the carbonate–depth profiles shows the interwoven plots (o's and x's). Increases and decreases of volumes within a till unit are usually gradual; the line joining both types of analyses shows little variation, if any, throughout the unit.

Some sidewall cores show erratic variations within a relatively uniform carbonate distribution through the till unit (Figures 9 and 10). This is attributed to those sidewall core depths that were near a contact which separates a different lithologic unit with a different carbonate content. This abrupt change in volumes for cores is also illustrated by the Meadow Lake testhole, Figure 3, at depths of 6 and 48 feet.

The linear regression curve, illustrated by Figure 11, shows the plots of the paired carbonate analyses. The calculated coefficient of correlation is 0.935, and this implies that not only are the results of the analyses from both

types of samples comparable, but also that both rotary cutting samples and the sidewall core samples which are recovered from similar intervals are from the same till units.

CONCLUSIONS

Rotary cutting samples have proved satisfactory for carbonate analyses. The cuttings are collected for a complete interval, and the carbonate parameter, be it volume or weight percent calcite and/or dolomite, is a mean value for the whole interval resulting in a more uniform parameter plot on the carbonate depth profile log.

Thickness of glacial drift in Saskatchewan is generally less than 150 metres. The Pasquia Hills testhole, Figure 2, shows comparable carbonate results for both types of samples, cores and cuttings, to this depth. Rarely, and only in specific locations such as buried valley fills, and ice–thrust moraines does the drift thickness exceed 150 metres.

Future analyses of rotary cuttings will prove or disprove their reliability as authentic samples for depths greater than 150 metres.

REFERENCES

Ross, W.C., 1986, Heinze Gasometer Method for the Quantitative Determination of Calcite and Dolomite in Tills, Saskatchewan Research Council Technical Report No. 215.

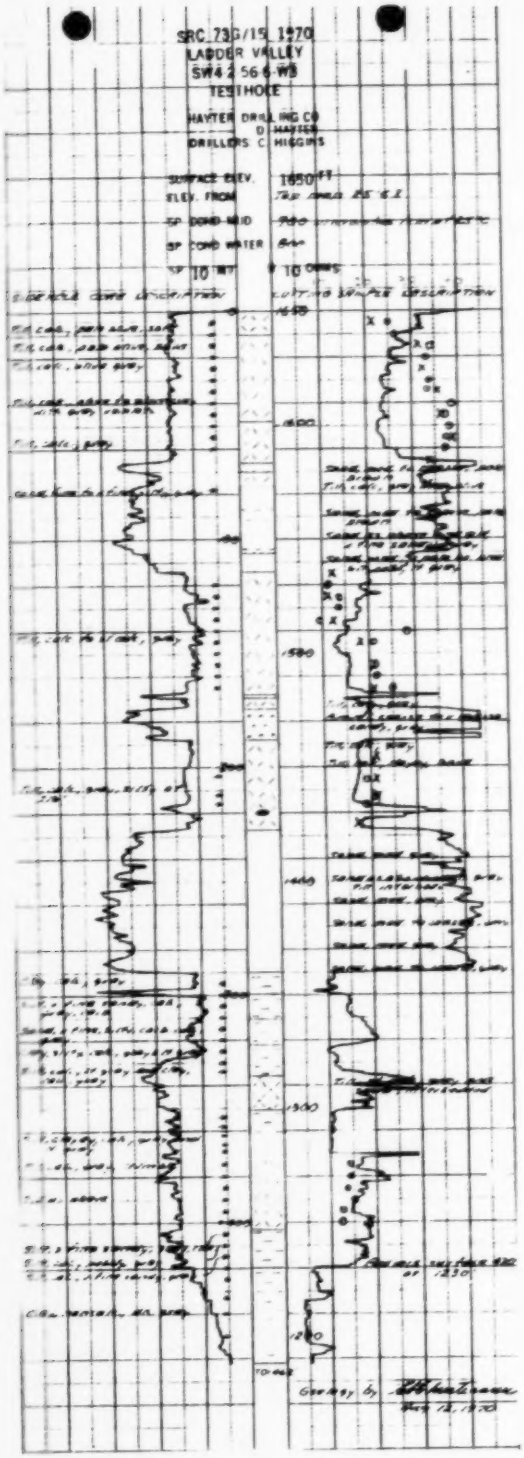


Figure 1. Depth Profile Plot – CO_2 Evolved: (mls/gm)

Laddur Valley Testhole
o – Sidewall Core
x – Rotary Cuttings

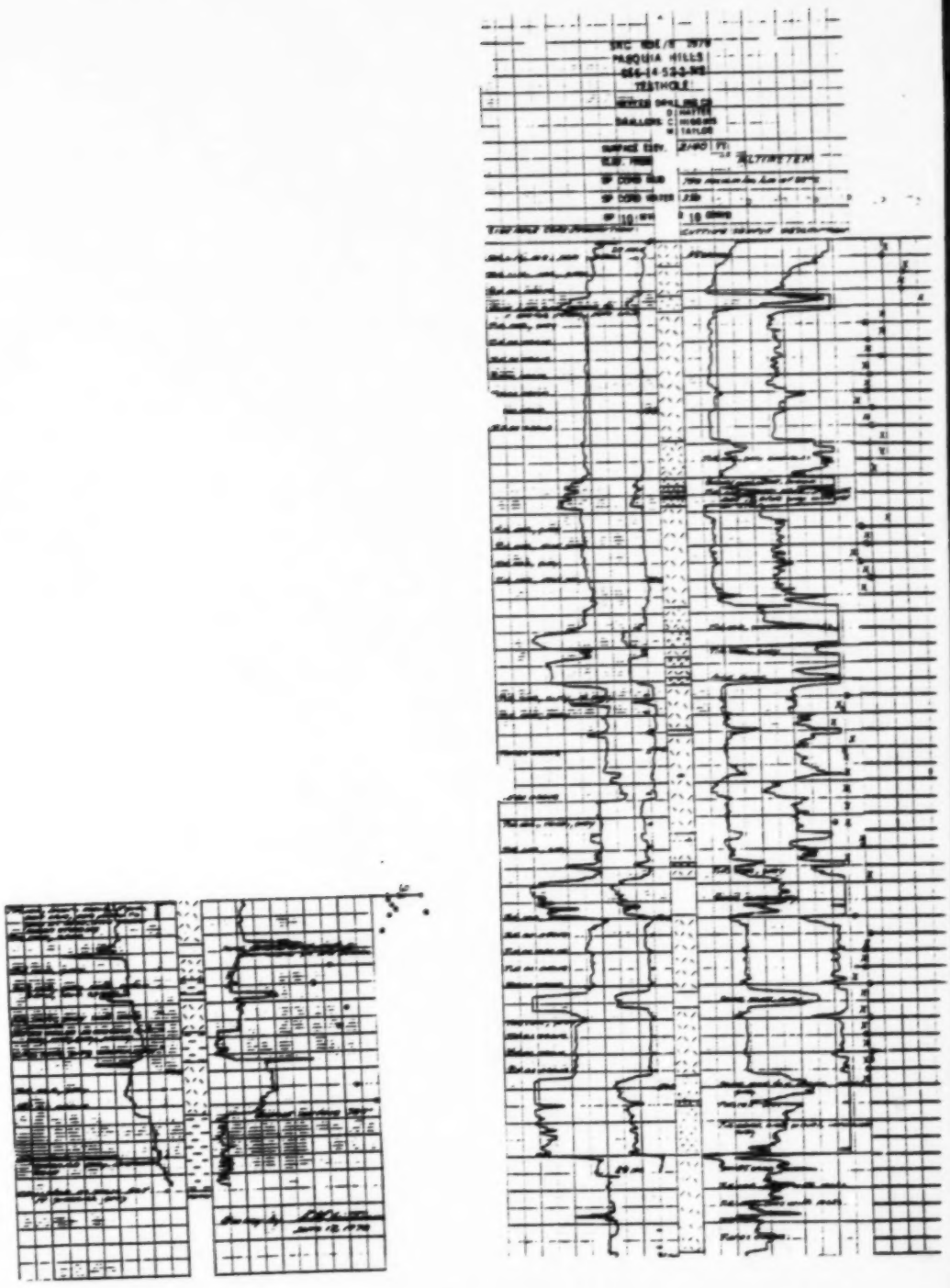


Figure 2. Depth Profile Plot – CO_2 Evolved: (mls/gm)

Pasquia Hills Testhole
o – Sidewall Core
x – Rotary Cuttings

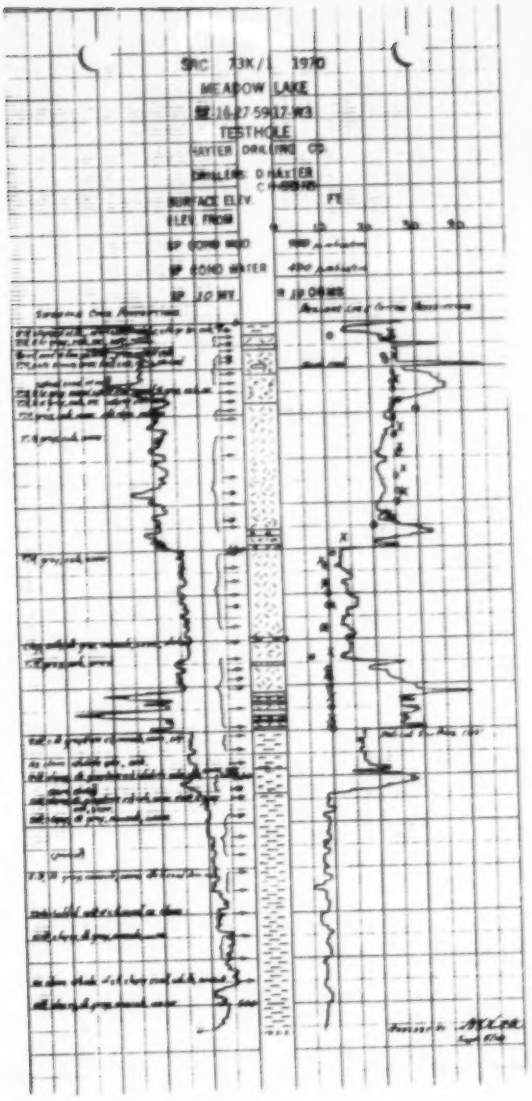


Figure 3. Depth Profile Plot – CO_2 Evolved: (mls/gm)

Meadow Lake Testhole
o – Sidewall Core
x – Rotary Cuttings

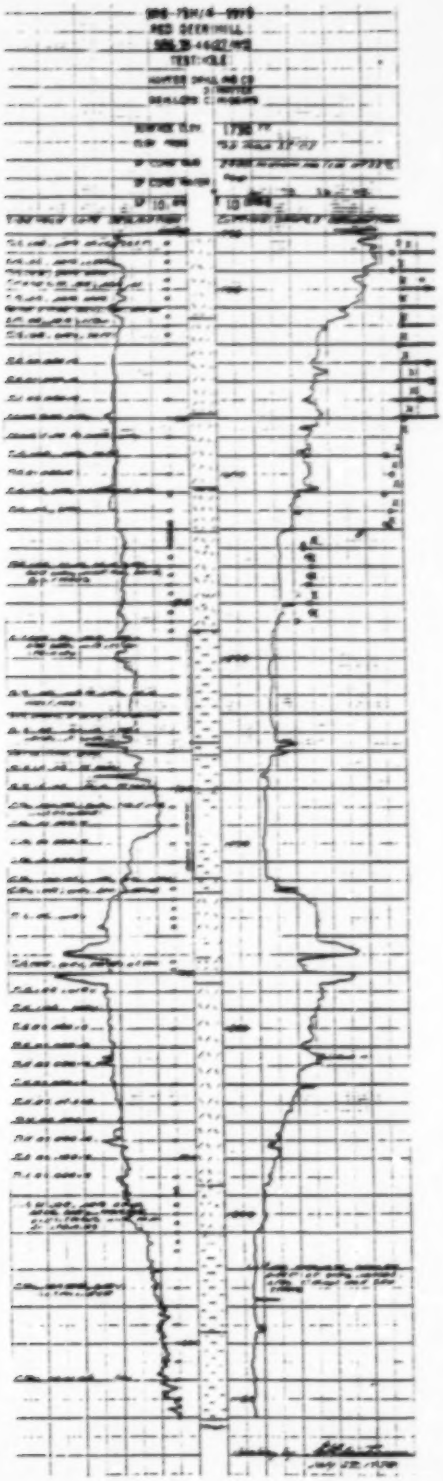


Figure 4. Depth Profile Plot – Red Deer Hill Testhole
– CO_2 Evolved: o – Sidewall Core
(mls/gm) x – Rotary Cuttings

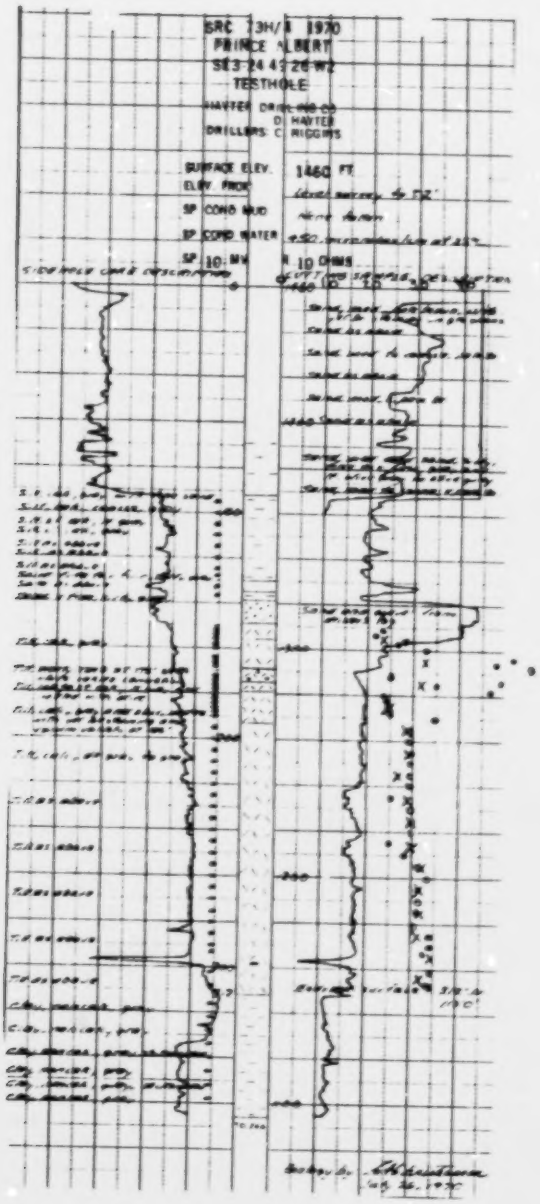


Figure 5. Depth Profile Plot – CO_2 Evolved: (mls/gm)

Prince Albert Testhole
o – Sidewall Core
x – Rotary Cuttings

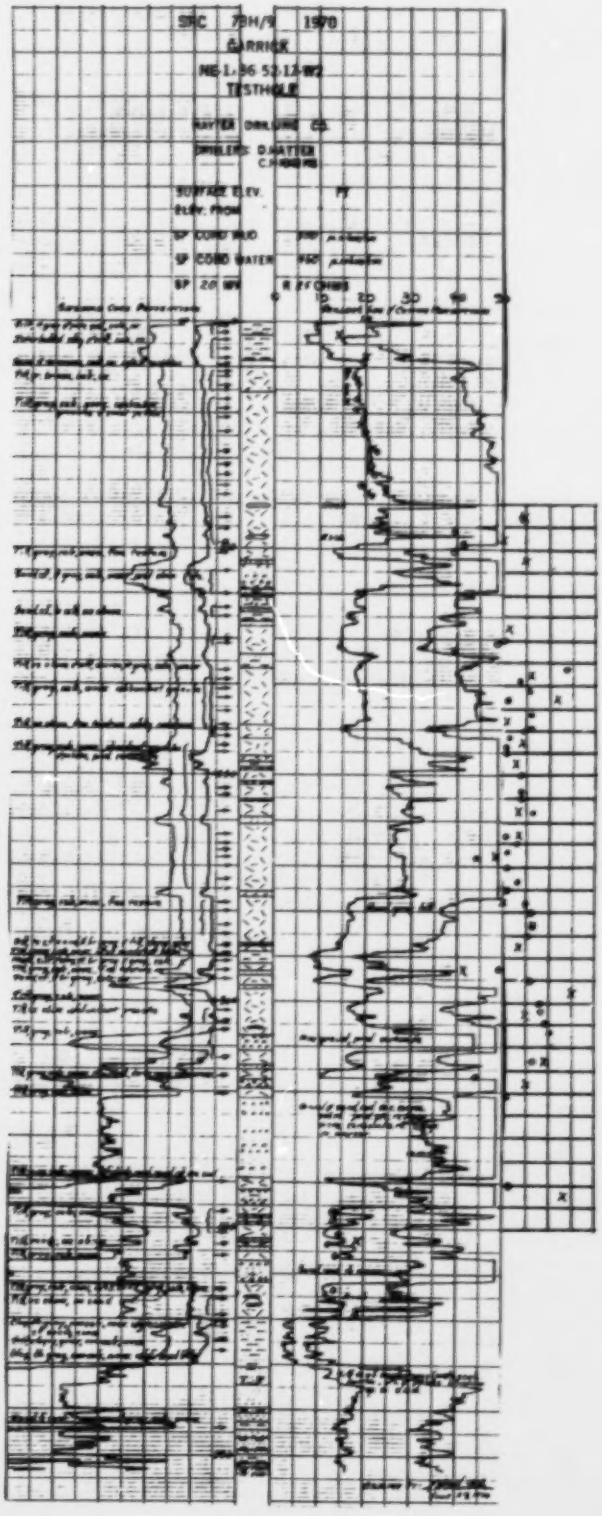


Figure 6. Depth Profile Plot – CO_2 Evolved: (mls/gm)

Garrich Testhole
o – Sidewall Core
x – Rotary Cuttings

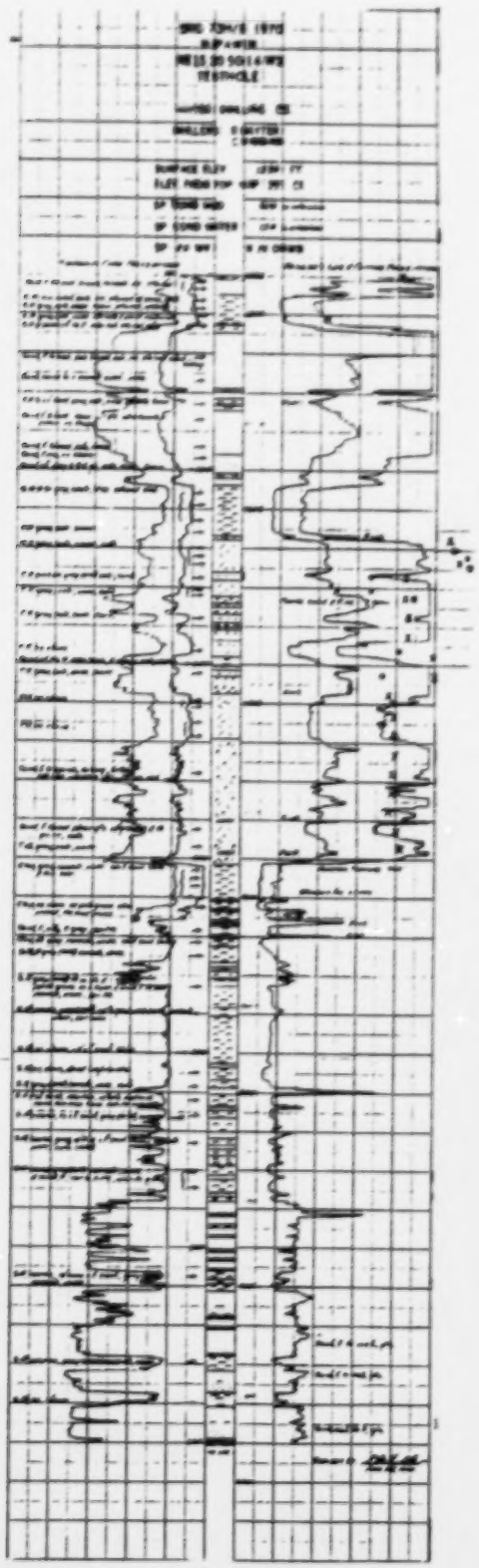


Figure 7. Depth Profile Plot – Nipawin Testhole
– CO_2 Evolved: o – Sidewall Core
(mls/gm) x – Rotary Cuttings

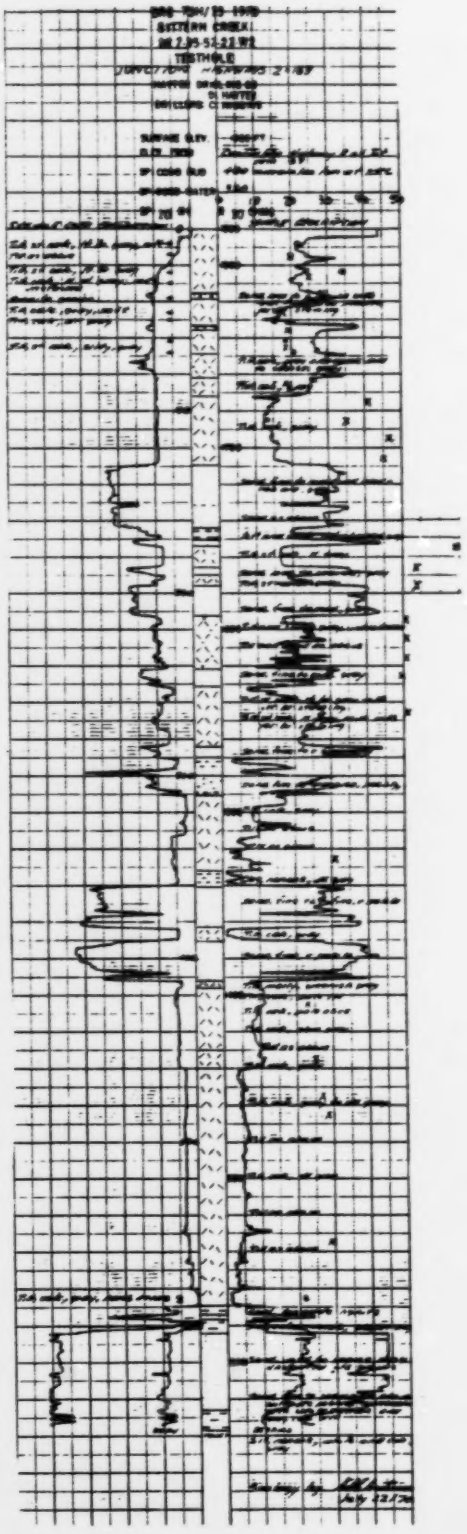


Figure 8. Depth Profile Plot – Bittern Creek Testhole
– CO_2 Evolved: (mls/gm)
o – Sidewall Core
x – Rotary Cuttings

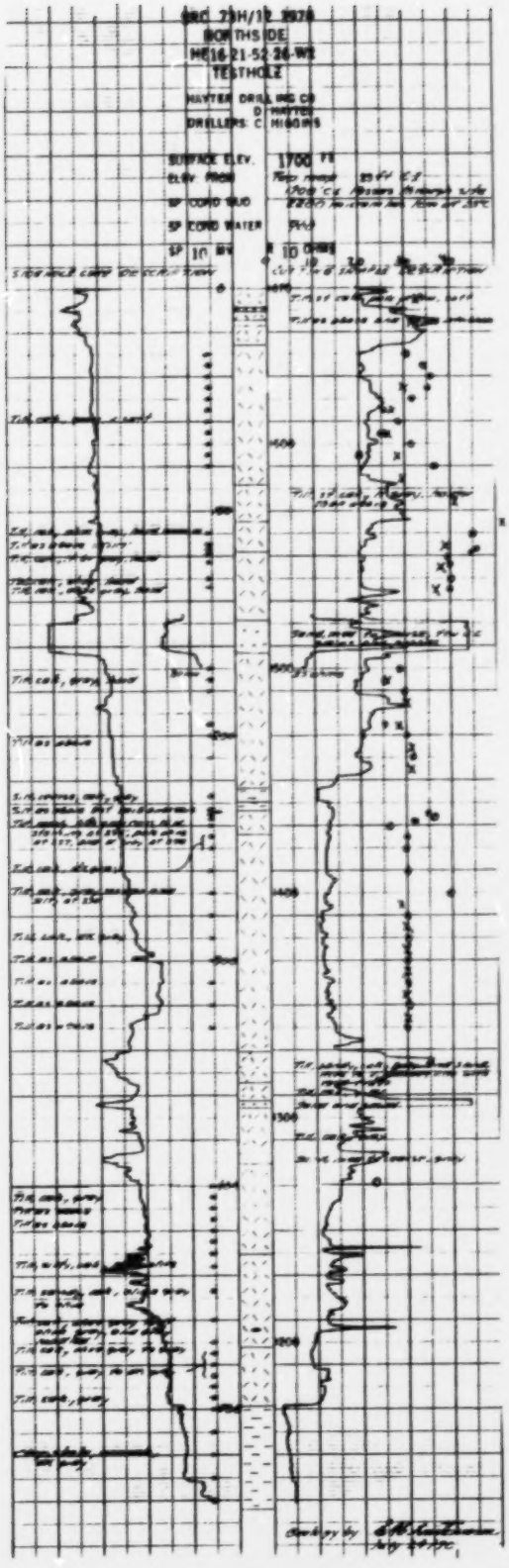


Figure 9. Depth Profile Plot – Northside Testhole
– CO_2 Evolved: (mls/gm)
o – Sidewall Core
x – Rotary Cuttings

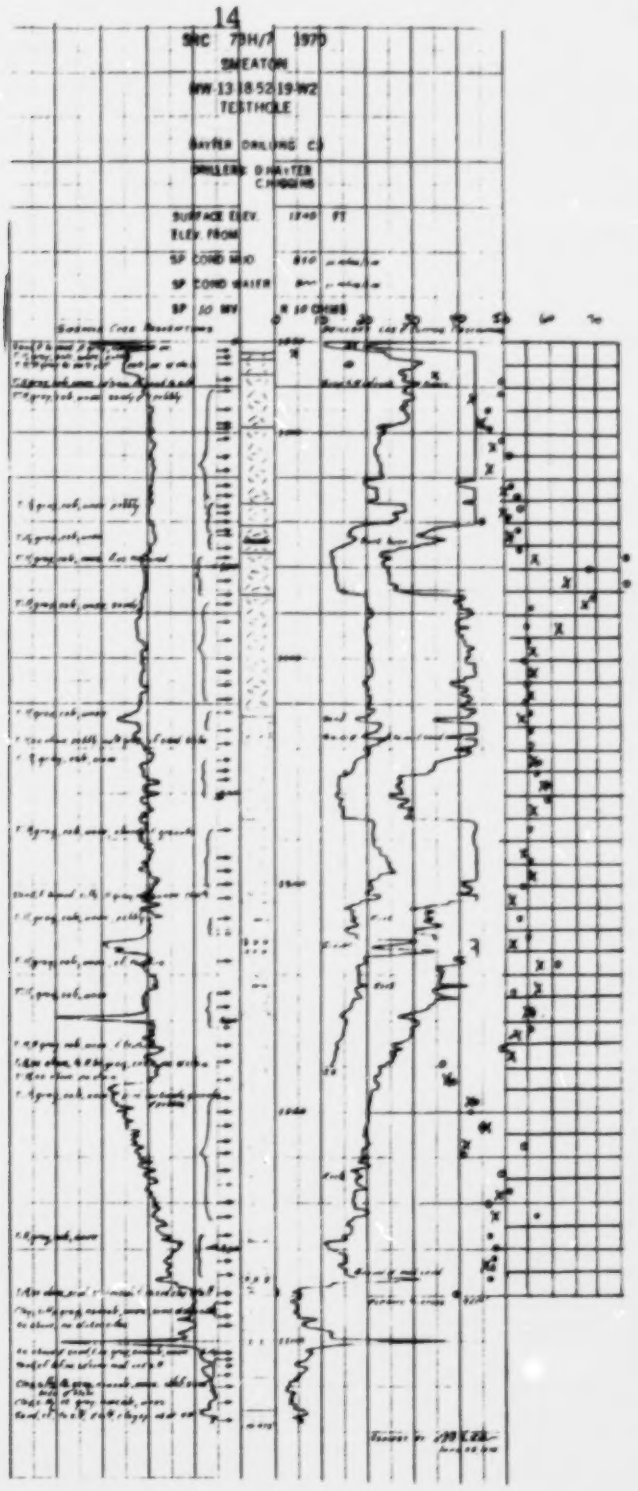
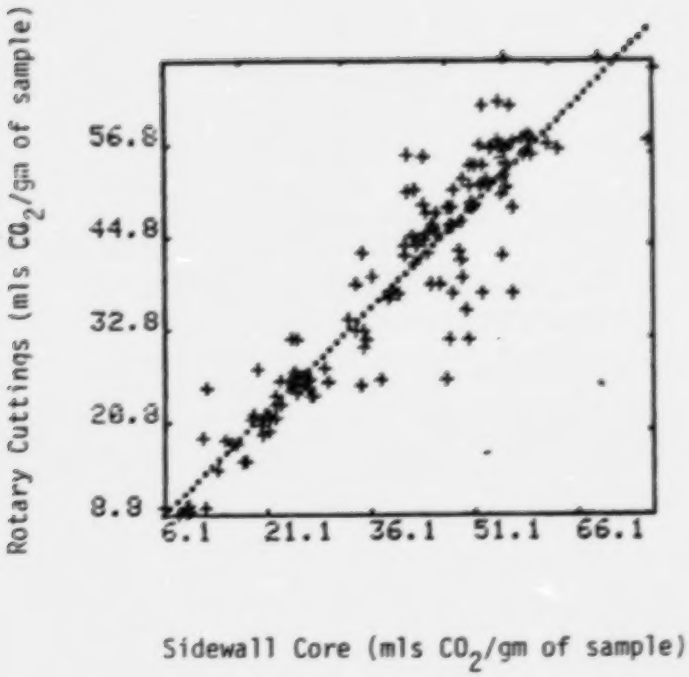


Figure 10. Depth Profile Plot – Smiaton Testhole
– CO_2 Evolved: o – Sidewall Core
(mls/gm) x – Rotary Cuttings



LINEAR REGRESSION RESULTS

INTERCEPT= +3.32

SLOPE= +0.90

Y= +3.32 +0.90X

COEF. OF DETERMINATION= +0.873

REGRESSION COEF.= +0.935

FIGURE 11 - LINEAR REGRESSION CURVE:
CO_2 Evolved by HCl on Till Samples -
Sidewall Core Versus Rotary Cuttings